

## Description of *Gastrolobium argyrotrichum* (Fabaceae: Mirbelieae), with taxonomic notes on some other species with bicoloured calyx hairs

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### Abstract

Hislop, M., Wege, J.A. & Webb, A.D. Description of *Gastrolobium argyrotrichum* (Fabaceae: Mirbelieae), with taxonomic notes on some other species with bicoloured calyx hairs. *Nuytsia* 24: 113–122 (2014). *Gastrolobium argyrotrichum* Hislop, Wege & A.D. Webb, a rare species endemic to the Metricup scarp south of Dunsborough in south-western Australia, is formally described. A key to species of *Gastrolobium* R.Br. with a bicoloured calyx indumentum and predominantly yellow or orange flowers is presented. Taxonomic notes are provided for *G. coriaceum* (Sm.) G.Chandler & Crisp, *G. dilatatum* (Benth.) G.Chandler & Crisp, *G. dorrieni* (Domin) G.Chandler & Crisp, *G. retusum* Lindl., *G. rhombifolium* G.Chandler & Crisp and *G. whicherense* G.Chandler & Crisp in order to facilitate future taxonomic work on the genus.

### Introduction

*Gastrolobium* R.Br. (Fabaceae: Mirbelieae (Benth.) Polhill & Crisp) was revised more than ten years ago (Chandler *et al.* 2002) at which time 109 species were recognised, including many previously placed in *Brachysema* R.Br., *Jansonia* Kippist and *Nemcia* Domin. As a result of this reclassification, *Gastrolobium* is now the largest genus of pea-flowered legumes from the tribe Mirbelieae in the South-West Botanical Province, and the third largest Australia-wide (after *Pultenaea* Sm. and *Daviesia* Sm.). Forty-six species are listed as rare, geographically restricted or poorly known (Smith 2013; Western Australian Herbarium 1998–), all of which are endemic to Western Australia.

The taxonomic monograph by Chandler *et al.* (2002) formed part of the lead author's PhD dissertation and is remarkable in scope, with its findings supported by concurrent molecular phylogenetic work (Chandler *et al.* 2001, 2003). While it has provided an invaluable reference to the taxonomy of this complex genus, and a framework for their conservation and management in Western Australia, some problems have become evident in regard to the taxonomic boundaries between some species. In certain groups, the complex morphological variation within and between closely allied species has not been fully addressed, giving the impression that the alpha-taxonomy is more clear-cut than is actually the case. However, it should be noted in this regard that, of the more than 5,000 specimen records of *Gastrolobium* at the Western Australian Herbarium (PERTH), less than half (*c.* 40%) were examined as part of this study (indeed, more than 1,000 specimens have been added to the PERTH collection since the monograph was published).

There are five informally phrase-named species of *Gastrolobium* on Western Australia's vascular plant census (Western Australian Herbarium 1998–), all of which are known from few collections and are therefore listed as being of conservation concern (Smith 2013). In the present study we address *G. sp. Quindalup* (H. Cole & D. Carter 577), which was discovered by Hazel Cole and Don Carter in 2002 during surveys of private property near Dunsborough in the south-west corner of the state. This taxon is one of a number in the genus that have bicoloured calyx hairs (dense white hairs basally, becoming golden brown or rusty apically), a dense, contracted inflorescence and a predominantly yellow or orange standard (note that all species have red coloration towards the base of the standard). Species with these attributes were included in the genus *Nemcia* prior to the study by Chandler *et al.* (2002). Our taxonomic evaluation of *G. sp. Quindalup*, which has resulted in its formal description below, has been undertaken as part of detailed conservation assessment, which suggests that this species warrants listing as Threatened in Western Australia. Our study has highlighted a number of taxonomic issues in morphologically allied species, of the kind alluded to above. These are briefly summarised to direct future taxonomic work on the genus. We also provide a key to the subset of *Gastrolobium* species with bicoloured calyces, condensed inflorescences and predominantly yellow or orange flowers to facilitate their identification.

### Taxonomy

***Gastrolobium argyrotichum*** Hislop, Wege & A.D. Webb, *sp. nov.*

*Type:* Quindalup, Western Australia [precise locality withheld for conservation reasons], 26 October 2003, H. Cole & D. Carter 656 (*holo:* PERTH 06551866; *iso:* CANB).

*Gastrolobium sp. Quindalup* (H. Cole & D. Carter 577), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au> [accessed 6 January 2014].

*Erect shrubs* to 1.5 m tall but more usually *c.* 1 × 1 m. *Branchlets* ascending, distinctly angular to subterete, densely sericeous. *Petioles* terete, continuous and decurrent with the branchlet, 1.5–3 mm long. *Leaves* patent to variously antrorse, in whorls of 3 (occasionally opposite or in whorls of 4), oblong to obovate, 10–30 × (4–)7–13 mm; apex shallowly emarginate to conspicuously bilobed, or almost truncate with flared lateral lobes, with a recurved, terminal mucro to 2 mm long and often also with short, fragile mucros, to 0.2 mm long, on the lateral lobes; margins undulate, recurved, thickened and minutely papillose; base rounded; upper surface with prominently reticulate and raised venation bearing minute papillae, scattered hairs usually present along the midrib; lower surface very densely sericeous. *Stipules* erect to recurved, linear-subulate, 4–6.5 mm long, sericeous. *Inflorescences* condensed, terminal (more rarely axillary), racemose, *c.* 6–20-flowered; peduncle 1–5 mm long, densely sericeous; rachis 2–10 mm long; subtending bracts caducous, 4.5–6 mm long, the lowest prominently trifold, the remainder entire or the margin distantly toothed, densely sericeous. *Pedicels* terete, 1.5–3 mm long, densely sericeous. *Calyx* campanulate, 5.5–6 mm long, including the *c.* 2.5 mm long receptacle, densely sericeous (the indumentum including some spreading hairs), hairs bicoloured, silky-white in the basal half becoming golden brown towards the apex; upper 2 lobes united higher than the lower 3, ± spreading, triangular, subacute, 2–2.3 mm long; lower 3 lobes erect, narrowly triangular, acute, 3.2–3.5 mm long. *Corolla:* standard limb transversely elliptic, 7–10 mm long including the 2.2–3 mm long claw, 7–10 mm wide, yellow with a dark red ring surrounding the yellow centre, apex emarginate or rounded, base ± truncate; wings 6.5–8.5 mm long including the 2.2–3 mm claws, 2.2–3.5 mm wide, yellow with dark red markings toward the base, apex rounded, incurved and overlapping to enclose the keel, base auriculate; keel 7.3–8.5 mm long including the 2.2–3 mm claws, 2.8–3.5 mm wide, dark red, apex rounded, base auriculate, saccate. *Style c.* 4–5 mm long, incurved, lower portion pubescent;



*ovary* shortly stipitate, densely pubescent, 4-ovulate. *Young pods* shortly stipitate, ovoid, moderately to densely pubescent. *Mature seeds* not seen. (Figure 1)

*Diagnostic features.* The following combination of features distinguish *G. argyrotichum* from all other species of *Gastrolobium* with condensed inflorescences, bicoloured calyx hairs and a predominantly orange or yellow corolla: young branchlets with a dense covering of white, appressed hairs; oblong to obovate leaves that are generally in whorls of three, and with recurved margins and an obtuse base; leaf apices that are shallowly emarginate to conspicuously bilobed, or almost truncate with flared lateral lobes, and with a recurved, terminal mucro and often also smaller, lateral mucros; an

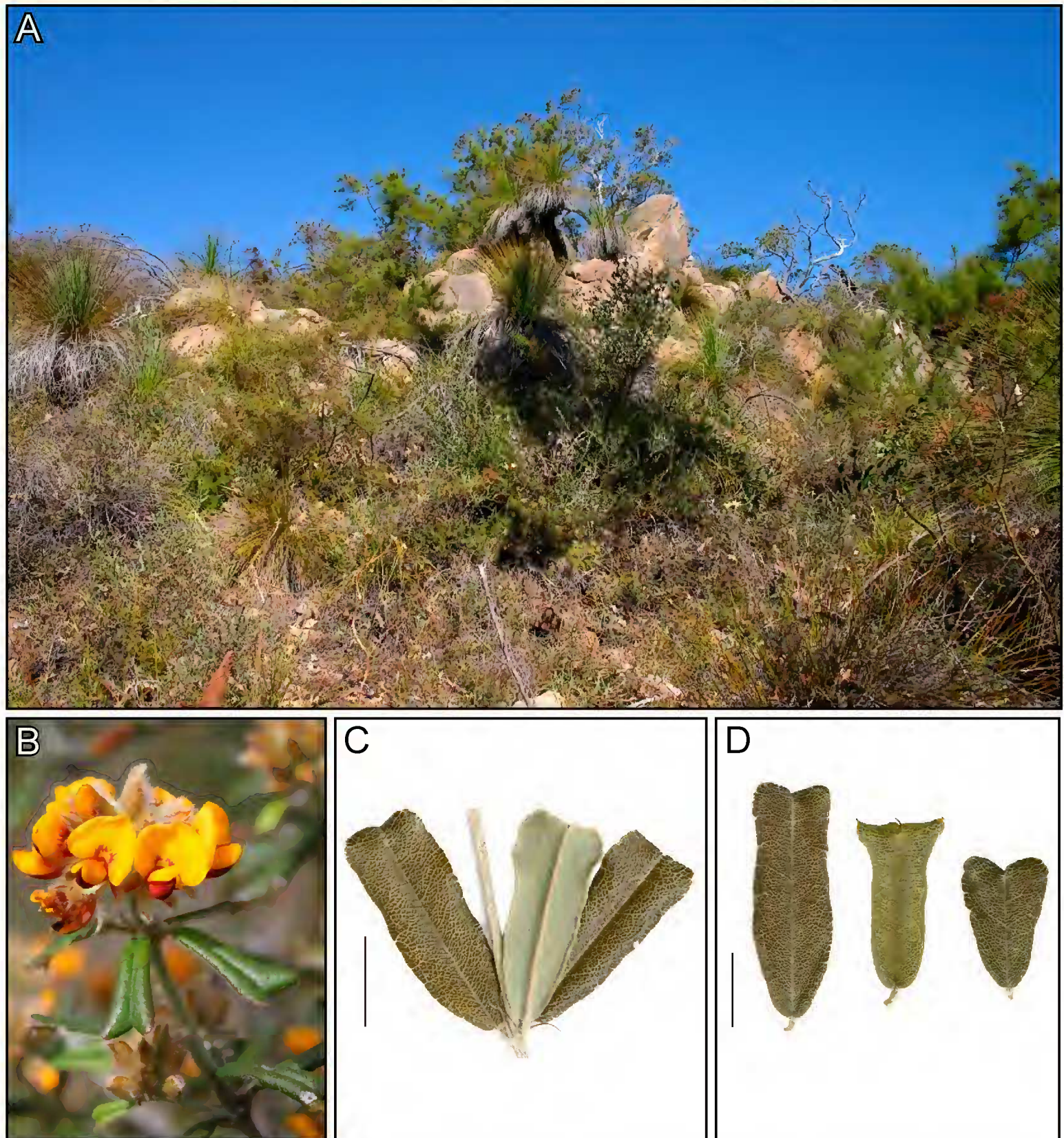


Figure 1. *Gastrolobium argyrotichum*. A – habitat with granite outcropping; B – flowering branch showing the condensed inflorescence of predominantly orange flowers and whorled, spreading leaves with recurved margins; C – a whorl of three leaves showing the silvery white appearance of the lower surface (middle leaf) and the dark green, strongly veined upper surface; D – variation in leaf shape. Field photographs by Ben Lullfitz (A) and Andrew Webb (B) from *A. Webb* AW 09032 and AW 09031 respectively; leaf detail from *H. Cole & D. Carter* 577, with scale bars at 1 cm.



upper leaf surface with very prominent, raised, papillose venation and with scattered hairs on the midrib (otherwise glabrous, including when young); a lower leaf surface with a very dense covering of silvery-white hairs; the ovary with four ovules.

*Other specimens examined.* WESTERN AUSTRALIA: [localities withheld for conservation reasons] 16 Oct. 2002, H. Cole & D. Carter 577 (PERTH); 26 Oct. 2003, H. Cole 657 (PERTH); 31 Oct. 2013, A. Webb AW 09031 (PERTH); 31 Oct. 2013, A. Webb AW 09032 (PERTH).

*Phenology.* Flowering in October and early November.

*Distribution and habitat.* *Gastrolobium argyrotrichum* is restricted to the northern extent of the Metricup Scarp, an area characterised by granitic and lateritic outcrops with shallow, gravelly loam soils. Located between Yelverton and Dunsborough in the far west of the Southern Jarrah Forest bioregion (Department of the Environment 2013), the Metricup Scarp is a very small landform 1–2 km wide that separates the Whicher Scarp from the Margaret River Plateau (Tille & Lantzke 1990). Two populations are known, the largest of which grows in shallow orange-brown loam amongst granite outcropping associated with a steeply incised seasonal streamline (Figure 1A). Associated species include *Corymbia calophylla*, *Xanthorrhoea preissii*, *Acacia pulchella*, *Darwinia citriodora*, *Cryptandra arbutiflora*, *Hibbertia hypericoides*, *Calothamnus sanguineus*, *Lepidosperma squamata* and *Tetraria capillaris*. The second population, which occurs in an area that has been subject to historical disturbance, is located within 1,500 m of the streamline population on an upper slope with orange lateritic gravel, but without granite outcropping.

*Conservation status.* *Gastrolobium argyrotrichum* is listed by Smith (2013) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the name *G. sp.* Quindalup (H. Cole & D. Carter 577). The Metricup Scarp is held extensively within private ownership, with the northern extent fragmented by small, semi-rural holdings and associated clearing. The two occurrences of *G. argyrotrichum* are in small public reserves and population sizes are very low. Suitable habitat for this species has been subject to detailed survey; however, no additional populations have been discovered, suggesting that it warrants listing as Threatened.

*Etymology.* From the Greek *argyros* (silver) and *trichos* (hair), in reference to the silvery white appearance of the densely hairy lower leaf surface and young branchlets.

*Proposed vernacular name.* Metricup Pea.

*Notes.* *Gastrolobium argyrotrichum* is morphologically similar to *G. dorrieni* (Domin) G.Chandler & Crisp, *G. retusum* Lindl. and *G. dilatatum* (Benth.) G.Chandler & Crisp. *Gastrolobium dorrieni* and *G. retusum* are sister taxa in the phylogeny presented by Chandler *et al.* (2001) and were placed in the ‘*G. retusum* group’ of Chandler *et al.* (2002), together with an additional 13 taxa (note *G. dilatatum* was not sequenced as part of this study and was left unplaced in this treatment). Like *G. argyrotrichum*, these three taxa have mostly ternate leaves, condensed terminal or axillary inflorescences, densely pubescent calyces with both white and golden brown hairs, and ovaries with four ovules (note the ovule number for both *G. dorrieni* and *G. dilatatum* is incorrectly cited as two in the descriptions provided in Chandler’s monograph). *Gastrolobium argyrotrichum* can be separated from these taxa by its distinctive leaf morphology (Figure 1); however, it does have leaf features in common with some or all of the morphotypes of the aforementioned taxa.

The leaves of *G. dorrienii* are obovate (sometimes narrowly so), with recurved margins, a shallowly emarginate or bilobed apex with rounded and unarmed lobes and a terminal mucro, an obtuse base, and a densely pubescent lower surface. While the leaves of *G. argyrotrichum* are also densely pubescent on the lower surface and can be similarly shaped, they are more commonly oblong to narrowly obovate with a more shallowly emarginate apex, or with a somewhat truncate apex with flared lateral lobes (see Figure 1B) and unlike *G. dorrienii*, these leaf lobes often possess a small mucro. *Gastrolobium dorrienii* and *G. argyrotrichum* can be definitively separated by their upper leaf surfaces, with the mature leaves of *G. dorrienii* having indistinct venation (the veins are prominent and conspicuously papillose in *G. argyrotrichum*) and the young leaves having a uniform covering of hairs (they are mostly glabrous on the upper surface in *G. argyrotrichum*). *Gastrolobium dorrienii* and *G. argyrotrichum* do not overlap in distribution, with the former occurring from near Darkan to the Chillinup area, including the Stirling Range.

*Gastrolobium retusum* has leaves that are commonly oblong to narrowly obovate with obtuse to shallowly emarginate apices, but they can be obovate and more deeply emarginate (to almost bilobed). The venation varies from obscure to prominent, but is not as conspicuously raised as that of *G. argyrotrichum* (which is accentuated by the presence of prominent papillae). Unlike *G. argyrotrichum*, specimens of *G. retusum* from its two main population centres (the northern Darling Range and the Cranbrook to Bremer Bay area) have leaves that are folded lengthways (i.e. V-shaped in section) and lack recurved margins. Leaf indumentum also separates *G. retusum* and *G. argyrotrichum* in most instances: the juvenile foliage in the former is uniformly pubescent on both surfaces and usually early glabrescent, whereas in *G. argyrotrichum* it is persistently and densely pubescent on the lower leaf surface only. Outlying specimens of *G. retusum* from the far south-west near Denmark (*A.R. Annels* ARA 1980; *B.G. Hammersley* 2060) and Mount Roe (*E.D. Middleton & D. Coffey* DC 13) are atypical in having leaves with somewhat recurved margins. Hairs are retained on the lower surface of the leaves in some additional outlying populations of *G. retusum* from near Donnybrook (*Stapleton Brothers s.n.*, PERTH 02819287) and the upper Blackwood (*Whistler Brothers s.n.*, PERTH 02819198), and also from near Gracetown (*D. Rooks* DJR 174, 175). The leaves of these specimens also have somewhat recurved margins. Also of note is a difficult-to-place outlying specimen from near Narrogin (*P. Rose* 229), which conforms to *G. retusum* in terms of leaf shape (oblong, shallowly emarginate and folded) but has a persistent lower surface indumentum.

*Gastrolobium dilatatum* has highly variable leaves that are generally obovate (sometimes narrowly so or tending obtrullate), folded lengthways or with recurved margins, and with obtuse to acuminate (more rarely truncate or shallowly emarginate) apices. The leaves usually have raised venation on the upper surface which is smooth or scarcely papillose, although in some collections the veins are somewhat indistinct (e.g. *T.E.H. Aplin* 838; *A. Markey* 158, 960). The venation is more prominent in *G. argyrotrichum* as well as conspicuously papillose. *Gastrolobium dilatatum* has attenuate or occasionally cuneate leaf bases (whereas they are obtuse in *G. argyrotrichum*) and with the exception of the apical mucro, the margins are otherwise unarmed (the leaf lobes often have small mucros in *G. argyrotrichum*).

The most obvious foliar difference between *G. dilatatum* and *G. argyrotrichum* concerns the indumentum. The juvenile foliage of both species is densely pubescent on the lower surface only, with the leaves of *G. dilatatum* quickly becoming completely glabrous. The exception to this is a variant from the northern Darling Range (herein termed the ‘Wandoo variant’; refer to the notes under *G. dilatatum* below), which differs from the typical form of the species in having a persistent (rarely partially glabrescent) lower leaf indumentum, a bilobed (rarely shallowly emarginate) leaf apex and an obtuse leaf base. Indeed, the overall leaf aspect of this variant approaches that of *G. argyrotrichum*, although

the lower surface indumentum is much less dense. Unlike *G. argyrotichum* and the typical form of *G. dilatatum*, the juvenile leaves of the Wandoo variant are densely hairy on both surfaces and the branchlet indumentum is spreading rather than appressed. *Gastrolobium dilatatum* is geographically distinct from *G. argyrotichum*, occurring in the Darling Range and adjacent eastern margin of the Swan Coastal Plain, from east of Perth south to near Yarloop.

Although we regard *G. argyrotichum* as a distinct taxon, consideration was given to treating it at subspecific rank given our reliance on foliar features to define it. However, in view of the complex morphological variation exhibited by close allies, it was not clear under which species to place it, and molecular work was beyond the scope of our study. We also felt that it was relevant in this regard that infraspecific rank was not used at all by Chandler *et al.* (2002).

### Key to species of *Gastrolobium* with a bicoloured calyx indumentum, condensed inflorescences and predominantly orange or yellow flowers<sup>1</sup>

1. Lower leaf surface glabrous or early-glabrescent
  2. Leaves broadly ovate or depressed-ovate, about as wide or wider than long, subsessile, the base deeply cordate, concealing the stem about the nodes, apical mucro sharply pungent..... **G. ferrugineum**
  - 2: Leaves variously shaped but not broadly ovate or depressed-ovate, always obviously longer than wide, clearly petiolate, the base various, but if cordate, never concealing the stem, apical mucro, if present, usually innocuous (sub-pungent in *G. rhombifolium*)
3. Ovules 2
  4. Leaf base smoothly attenuate; margins usually prominently undulate..... **G. crispatum**
  - 4: Leaf base rounded; margins rarely undulate
    5. Leaves mostly ovate, less often elliptic; branchlet and peduncle indumentum dense, tangled, hairs ferruginous on the peduncle ..... **G. pyramidale**
    - 5: Leaves mostly obovate, less often elliptic; branchlet and peduncle indumentum  $\pm$  straight, variously antrorse, hairs silvery throughout..... **G. crenulatum**
- 3: Ovules 4
  6. Leaf apex trilobed, usually with each of the lobes stiffly mucronate, the lateral lobes on some leaves occasionally without mucros..... **G. rhombifolium**
  - 6: Leaf apex entire, emarginate or variously lobed but if trilobed then the two lateral lobes never mucronate
    7. Most, or at least some leaves, ovate or narrowly so, the remainder elliptic or occasionally obovate; apex entire, obtuse; base cuneate, rounded or occasionally cordate..... **G. whicherense**
    - 7: Leaves variously obovate or narrowly elliptic to  $\pm$  oblong; apex emarginate or variously lobed, or if entire, then either truncate, obtuse or acuminate; base smoothly attenuate, cuneate or rounded
      8. Longest leaves 30–60 mm long, widest leaves 10–30 mm wide; leaves variously obovate, usually with undulate margins in upper half; apex very variable, truncate, obtuse, acuminate, emarginate, bilobed or trilobed; base usually smoothly attenuate, occasionally cuneate
      9. Leaves glaucous; apex trilobed; leaves mostly opposite at upper nodes ..... **G. rhombifolium** (eastern variant)



- 9: Leaves not glaucous; apex various, as for couplet 7 above, including trilobed; all leaves in whorls of 3 or 4..... **G. dilatatum**
- 8: Longest leaves 10–25(–30) mm long, widest leaves 4–12 mm wide; leaves narrowly obovate or oblong to narrowly elliptic, without undulate margins; apex usually emarginate or obtuse, less often markedly bilobed; base cuneate or rounded
- 10: All leaves in whorls of 3 ..... **G. retusum**
- 10: Leaves frequently opposite at upper nodes ..... **G. retusum** (northern variant)
- 1: Lower leaf surface sericeous or occasionally partially glabrescent in older leaves
- 11: Leaves opposite at upper nodes, narrowly ovate, narrowly elliptic to oblong..... **G. elegans**
- 11: Leaves in whorls of 3, variously shaped but usually broader than above
- 12: Leaves ovate or elliptic, sometimes narrowly so, rarely a few leaves obovate, if narrowly elliptic then the margins strongly recurved
- 13: Lower leaf surface at least partially glabrescent on older leaves ..... **G. whicherense**
- 13: Lower leaf surface with persistent indumentum on older leaves..... **G. coriaceum**
- 12: Leaves variously obovate or if occasionally narrowly elliptic then folded lengthways (i.e. V-shaped in section)
- 14: Branchlet indumentum spreading ..... **G. dilatatum** (Wandoo variant)
- 14: Branchlet indumentum appressed
- 15: Young leaves densely pubescent on lower surface only; upper surface of mature leaves with prominent, raised venation, markedly papillose (especially on the veins) ..... **G. argyrotrichum**
- 15: Young leaves pubescent on both surfaces; upper surface of mature leaves with indistinct, barely raised venation, not or minutely papillose (only observable under high magnification) ..... **G. dorrienii**

<sup>1</sup>The species keyed out here are an artificial grouping, but one that is readily defined by an easily interpreted character combination. Note that it does not include those species that, while having a bicoloured calyx indumentum, have either predominantly red-flowers or an elongate inflorescence.

### **Notes on some taxonomic issues relating to species of *Gastrolobium* with a bicoloured calyx indumentum, condensed inflorescences and predominantly orange or yellow flowers**

***Gastrolobium coriaceum*** (Sm.) G.Chandler & Crisp, *Austral. Syst. Bot.* 15: 687 (2002).

*Notes.* While the PERTH specimen database indicates that *G. coriaceum* occurs no farther west than the Denmark area, a specimen at the Australian National Herbarium (CANB) from the Whicher Range (C.E. & D.T. Woolcock W2355) was cited by Chandler *et al.* (2002) under this species. It is of note that the typical form of *G. coriaceum* is very similar to a collection currently housed under *G. whicherense* at PERTH (refer to the comments under that species), apparently differing only in the persistence of an indumentum on the leaf lower surface. If confirmed as *G. coriaceum* and not *G. whicherense*, this CANB record would represent a significant disjunction.

A narrow-leaved morphotype of *G. coriaceum* from the Denmark area needs investigation as a potentially distinct taxon. A specimen of this morphotype (*B.G. Hammersley* 1684) was determined as *G. elegans* G.Chandler & Crisp by Chandler in 2000, although according to two earlier determinations (*M.D. Crisp* 8929 & *W. Keys*; *L. Binks s.n.*, PERTH 01045261), Crisp considered it to be a variant of *G. coriaceum*. No specimens of this entity were cited under either species by Chandler *et al.* (2002). The only obvious difference between *G. elegans* and the narrow-leaved morphotype of *G. coriaceum* is phyllotaxis (opposite leaves in the former and consistently ternate in the latter). PERTH's holdings of the narrow-leaved morphotype were previously spread across the two species but they have recently been brought together under *G. coriaceum*. On the basis of this new information the conservation status of *G. elegans* has been re-evaluated and is now Priority Two under Department of Parks and Wildlife Conservation Codes for Western Australian Flora (Smith 2013).

***Gastrolobium dilatatum*** (Benth.) G.Chandler & Crisp, *Austral. Syst. Bot.* 15: 703 (2002).

*Notes.* As currently understood, this species is particularly variable in leaf shape and to some extent flower size. Some of these variants closely approach *G. rhombifolium* (refer to the comments under that species) and *G. dorrieni* (see ensuing paragraph). It can also be difficult to separate from *G. crispatum*, the leaf shape of the two sometimes being more or less indistinguishable. In addition *G. dilatatum* also frequently shares with that species undulate leaf margins. In such cases the two can only be reliably separated by ovule number, two for *G. crispatum* G.Chandler & Crisp and four for *G. dilatatum* (note the description of *G. dilatatum* in Chandler *et al.* (2002) incorrectly indicates that this species has two ovules).

An anomalous morphotype, referred to here as the Wandoo variant, occurs in the northern Darling Range, mostly in the vicinity of Wandoo National Park (*R. Davis* 4277, 6403; *F. Hort* 670, 744; *F. & J. Hort* 633, 635; *F. Hort, J. Hort & R. Butcher* 672; *M.D. Crisp* 8512 & *W. Keys*). Although the last specimen was cited by Chandler *et al.* (2002) under *G. dilatatum*, its placement within this species appears problematic and a case could equally be made for its inclusion in *G. dorrieni* or for its recognition as a distinct taxon. This morphotype is characterised by a spreading branchlet indumentum, ternate leaves, a bilobed (rarely shallowly emarginate) leaf apex and persistent hairs on the leaf lower surface. When compared to the morphology of *G. dilatatum* specimens from elsewhere in the species' range, the following differences are notable: leaves consistently shorter; branchlet indumentum spreading rather than appressed; young leaves hairy on both surfaces rather than just the lower surface; lower surface of mature leaves hairy rather than glabrous; peduncles generally shorter. The bilobed leaf apex found in the Wandoo variant is otherwise uncommon in *G. dilatatum*, but is present in the species it most closely resembles, *G. dorrieni*. The distribution of the latter, however, lies well to the south of that of *G. dilatatum*, from south of Darkan to a little east of the Stirling Range. The Wandoo variant can be distinguished from *G. dorrieni* by its more obviously reticulate upper leaf surfaces and by the presence of a spreading rather than appressed branchlet indumentum.

The Wandoo variant of *G. dilatatum* overlaps in distribution with the northern populations of *G. retusum* and there has been confusion between the two. The latter can be distinguished by its narrower, differently shaped leaves (narrowly obovate-elliptic to narrowly elliptic *cf.* obovate to narrowly obovate) which are more rounded at the base (rounded to cuneate *cf.* attenuate to cuneate) and usually with emarginate to entire, rather than bilobed leaf apices. In addition, the juvenile leaves are only hairy on lower surfaces, quickly becoming glabrescent as they mature, and the mature leaves are more strongly folded lengthways and are not undulate in the upper half. Whereas the northern variant of *G. retusum* mostly has opposite leaves at the upper nodes, they are always whorled in *G. dilatatum* (including the Wandoo variant).



***Gastrolobium dorrienii*** (Domin) G.Chandler & Crisp, *Austral. Syst. Bot.* 15: 675 (2002).

*Gastrolobium dorrienii* and *G. retusum* are sister taxa in the study of Chandler *et al.* (2001) and the following foliar characters were used by Chandler *et al.* (2002) to distinguish between them: leaf curvature (leaf margins recurved in *G. dorrienii* and not so in *G. retusum*), leaf apex (distinctly lobed vs emarginate to entire), venation on upper leaf surface (obscure vs prominently reticulate), and indumentum on the lower surface (moderately pubescent vs early glabrescent). In their usual form, the leaves of *G. retusum* also differ from *G. dorrienii* in being folded lengthways (i.e. V-shaped in section) and generally also have a higher length to width ratio. Where their distributions overlap in Stirling Range National Park, the two species do generally retain most of these differences and instances where these characters break down (e.g. *V.E. Sands* 638.15.5) are potentially the result of hybridisation. All of these foliar characters are, however, subject to breakdown in varying degrees and in different combinations when specimens from across the range of these two species are considered. Leaf venation varies from obscure to prominent in *G. retusum*, leaf apices vary from bilobed to shallowly emarginate in *G. dorrienii* and from deeply emarginate to obtuse in *G. retusum*, and several outlying specimens of *G. retusum* bear similarity to *G. dorrienii* in having either a persistent indumentum on the lower leaf surface or somewhat recurved margins (refer to the notes under *G. argyrotrichum* above).

We have not performed an exhaustive comparison of the additional characters previously used to separate *G. retusum* and *G. dorrienii*, although we note that the length of the stipules, calyx, peduncles and rachides do not appear to be taxonomically informative, and that specimen labels suggest a degree of variation in habit and flower colour (yellow or orange) in both species. Comparative DNA analysis from across the range of these species and targeted field work are necessary to improve our taxonomic understanding.

***Gastrolobium retusum*** Lindl., *Edwards's Bot. Reg.* 19, Tab. 1647 (1834).

*Notes.* This species has a significantly disjunct distribution with two main population centres, one in the northern Darling Range and the other in the Cranbrook to Bremer Bay area. Outlying populations occur near Gracetown, in the southern forests near Mount Roe and Denmark, and near Narrogin. These outliers are not typical for *G. retusum* and show foliar characters that are, in one way or another, intermediate with those of *G. dorrienii* (see notes under both *G. argyrotrichum* and *G. dorrienii* above). We have annotated the relevant PERTH specimens as *G. aff. retusum*.

Chandler *et al.* (2002) noted that *G. retusum* is a variable species requiring additional taxonomic work. They indicate that sequence samples from the north and south of the species' range (*G.T. Chandler* 188 from Bindoon and *G.T. Chandler* 427 from Bremer Bay) were placed on separate branches of their phylogeny. These data obviously raise the question as to whether the northern and southern populations of *G. retusum* are separate taxa. The only potentially significant morphological difference between plants from the two main population centres noted during this study was that of phyllotaxis: whereas in the southern populations it is consistently ternate, northern plants often show a mixture of opposite and ternate, or are occasionally opposite throughout, and are only rarely uniformly ternate. No specimen voucher for the Bindoon sample appears to have been lodged at any Australian herbaria and so its identity cannot be readily checked. It is of note that there are no collections of this species at PERTH from that far north, although an outlying population occurs nearby at Muchea.

***Gastrolobium rhombifolium*** G.Chandler & Crisp, *Austral. Syst. Bot.* 15: 683 (2002).

*Notes.* Some specimens of *G. dilatatum* (e.g. *J. Seabrook* 391) have leaves that closely resemble

those of *G. rhombifolium*. While the latter species can usually be differentiated by the presence of stiff mucros on the two lateral (as well as the terminal) leaf lobes, a significant number of leaves may be present in which the lateral lobes are not or barely mucronate (e.g. *M.D. Crisp* 8914 & *W. Keys*; *F. Hort & J. Hort* 2894). In such cases, the only other difference relative to *G. dilatatum* appears to be the glaucous aspect of *G. rhombifolium*.

Specimens of *G. rhombifolium* at the south-eastern end of its range near Narrogin (e.g. *R. Davis* RD 1478) have lateral leaf lobes that are apparently never mucronate, although they still retain the glaucous aspect of *G. rhombifolium*. This morphotype also differs from both typical *G. rhombifolium* and *G. dilatatum* in having mostly opposite rather than ternate leaves.

***Gastrolobium whicherense*** G.Chandler & Crisp, *Austral. Syst. Bot.* 15: 676–677 (2002).

*Notes.* This species is currently poorly known, with very few good-quality specimens available for study. Indeed the holotype was the only specimen cited by its authors, and since this specimen remains on loan to CANB, the application of this name is unclear. The 13 collections that are currently assigned to this species at PERTH are morphologically variable and are likely to represent more than one taxon. They include both a broad-leaved morphotype (*R.J. Cranfield* 17622) which is very similar to *G. coriaceum*, apparently differing only in the leaf lower surface becoming more or less glabrescent, and a narrow-leaved morphotype (*G.L. Liddelov s.n.*, PERTH 04611179) which has an apparently persistent lower surface indumentum and an ovary with two rather than four ovules. A further complication is the presence of another poorly known, undescribed taxon from the general vicinity of the Whicher Range, *G. sp.* Yoongarillup (*S. Dilkes s.n.* 1/9/1969). While this was given the manuscript name *Nemcia cordata* ms by Crisp, who also included it in his key to *Nemcia* species (Crisp & Mollemans 1993), it was mistakenly overlooked in the *Gastrolobium* monograph (G. Chandler *in litt.* 2002). *Gastrolobium sp.* Yoongarillup has relatively broad leaves which are glabrous on their lower surfaces, an ovary with two ovules, and a uniformly silvery calyx indumentum. There is an urgent need to resolve the taxonomic doubt surrounding these entities as none appear to be common; however, it will be difficult to proceed without targeted field work to obtain more material.

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